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Nilpotent singularities and oscillations in SIR type of compartmental models

The dynamics of SIR type of compartmental models can be complicated due the demographics and incidence mechanisms. In this talk, I will present SIR type of compartmental models with a standard incidence rate and a nonlinear recovery rate to reflect the impact of available resources of public health system especially the number of hospital beds. Cusp, focus and elliptic type of nilpotent singularities of of co-dimension 3 are discovered and analyzed in this three dimensional model. Complex dynamics of disease transmission including multi-steady states and multi-periodicity are revealed by bifurcation analysis. Large-amplitude oscillations found in our model provide a more reasonable explanation for disease recurrence. This is a joint work with Chunhua Shan.